Crestron Electronics, Inc.

# CaptureLiveHD®
# Design Guide

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# Introduction

CaptureLiveHD® is a suite of products that work seamlessly together to deliver a high-quality meeting and lecture capture solution that is simple to use and affordable to implement.

CaptureLiveHD provides the following:

- Content recording for digital and analog sources (HDMI® and VGA) for computer, document camera, unencrypted DVD, and Blu-ray Disc™
- Audio recording for stereo content audio and microphone(s)
- Distribution for recording, uploading, and streaming live

## Complete CaptureLiveHD Solution

A complete CaptureLiveHD solution includes a Capture HD® High-Definition Capture Recorder (CAPTURE-HD) recorder in every room, all managed by Fusion RV®. Crestron® Fusion RV is a powerful platform for managing rooms and technology. CaptureLiveHD leverages the Media Services component of Fusion RV to deliver a total workflow engine for moving recorded content seamlessly through the entire process from capture to consumption with minimal effort. Viewers can watch content in true HD on virtually any device, including a PC, Mac®, iPad®, iPhone®, or Android™ device.

### CaptureLiveHD Product List

The CaptureLiveHD includes the following products.

**High-Definition Capture Recorder**

- CAPTURE-HD: HD Capture Recorder with SD Camera Recording
- CAPTURE-HD-PRO: HD Capture Recorder with SD and HD Camera Recording

**Camera**

- CAM-IFB-100: Compact HD Streaming and SD Analog Video Camera
- CAM-IPTZ-101: PTZ Streaming and Analog Video Camera

**Microphone**

- MP-FS100 PAK: FreeSpeech® Single-Channel Wireless Mic System Package
- MP-FS200 PAK: FreeSpeech Dual-Channel Wireless Mic System Package

**Control Interface**

- CAPTURE-TPMC-4SM: Touch Screen Controller for CAPTURE-HD
- Any other Crestron touch screen, or mobile device running Crestron Mobile® or Crestron Mobile Pro® via an Ethernet-based Crestron control system

**Software**

- Fusion RV® with Media Services: Enterprise Management Platform
- Crestron Media Player: Streaming media player

## Why Choose CaptureLiveHD?

Refer to the comparison chart below for reasons to choose CaptureLiveHD.

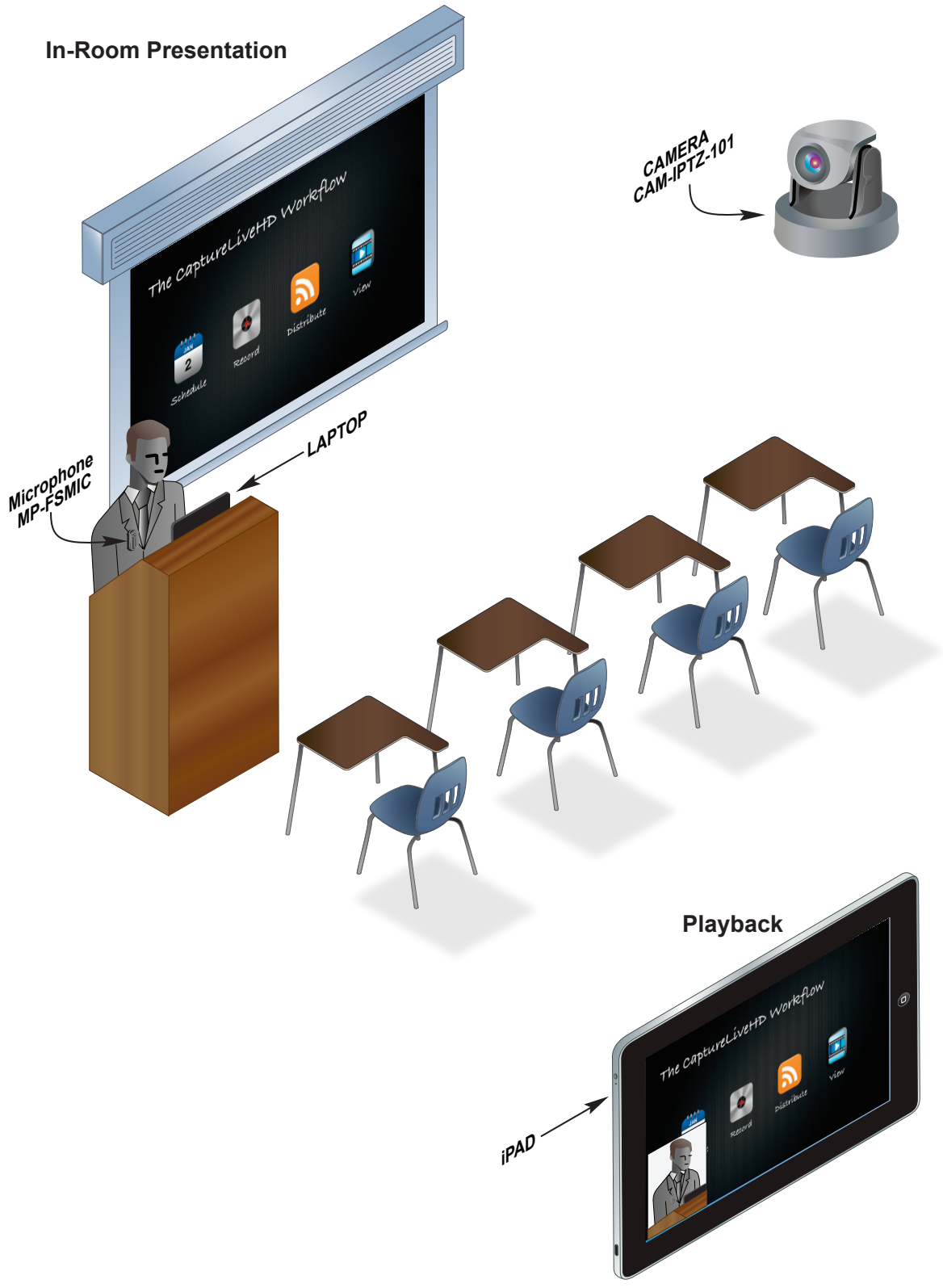
| Crestron CaptureLiveHD | Other Capture Solutions |
|---|---|
| HD, full motion video content (1080p) | Screen grab, low fps (frames per second) |
| SD™ (composite) or HD (SDI) camera | SD camera |
| Low per-room cost | Expensive hardware |
| No recurring fees | Required subscriptions |

**NOTE:** Refer to the CaptureLiveHD and CAPTURE-HD web pages on the Crestron website for case studies and articles regarding Crestron solutions applied in corporate, educational, healthcare, and government settings.

## About this Document

This design guide is intended for an AV integrator, IT classroom technology manager, and corporate AV manager to use when implementing Crestron CaptureLiveHD in a facility. It covers the hardware and software required for CaptureLiveHD. This design guide provides the information required to design a Crestron CaptureLiveHD system of any size or complexity.

*In-Room Recording and Viewing Experience*



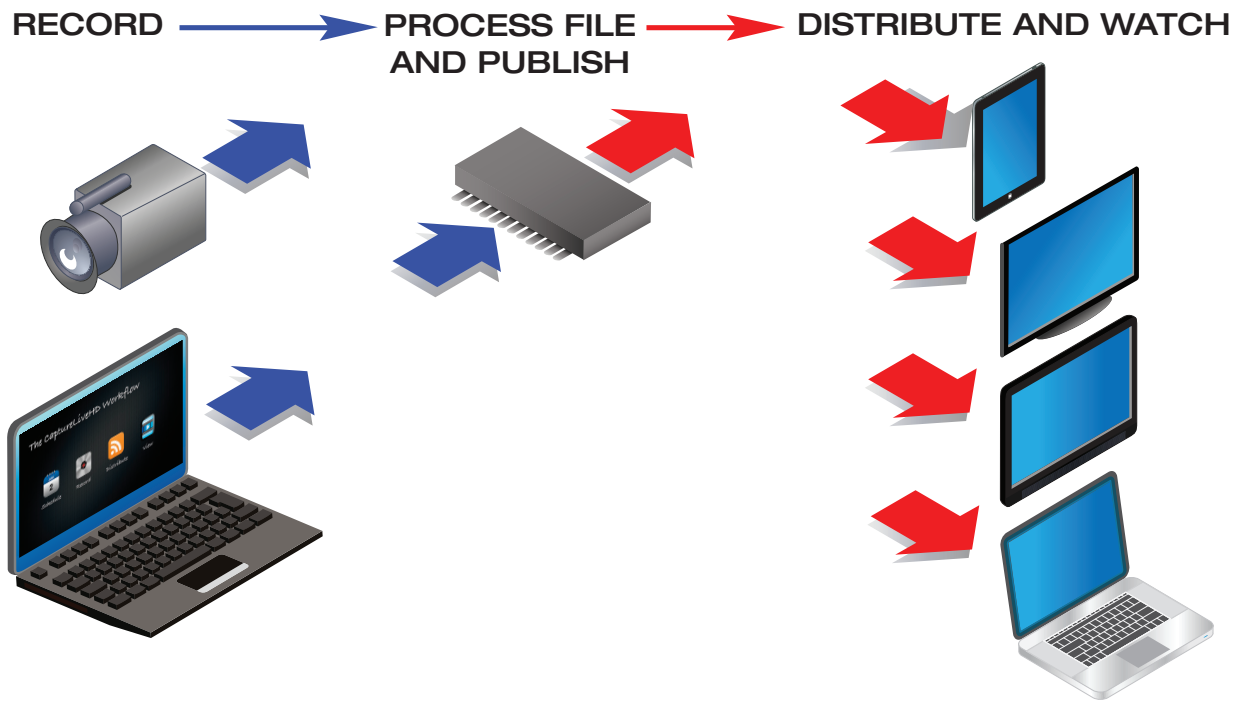
# CaptureLiveHD System Overview

There are three main components to the CaptureLiveHD system. Each component has a corresponding task and location as shown in the table below.

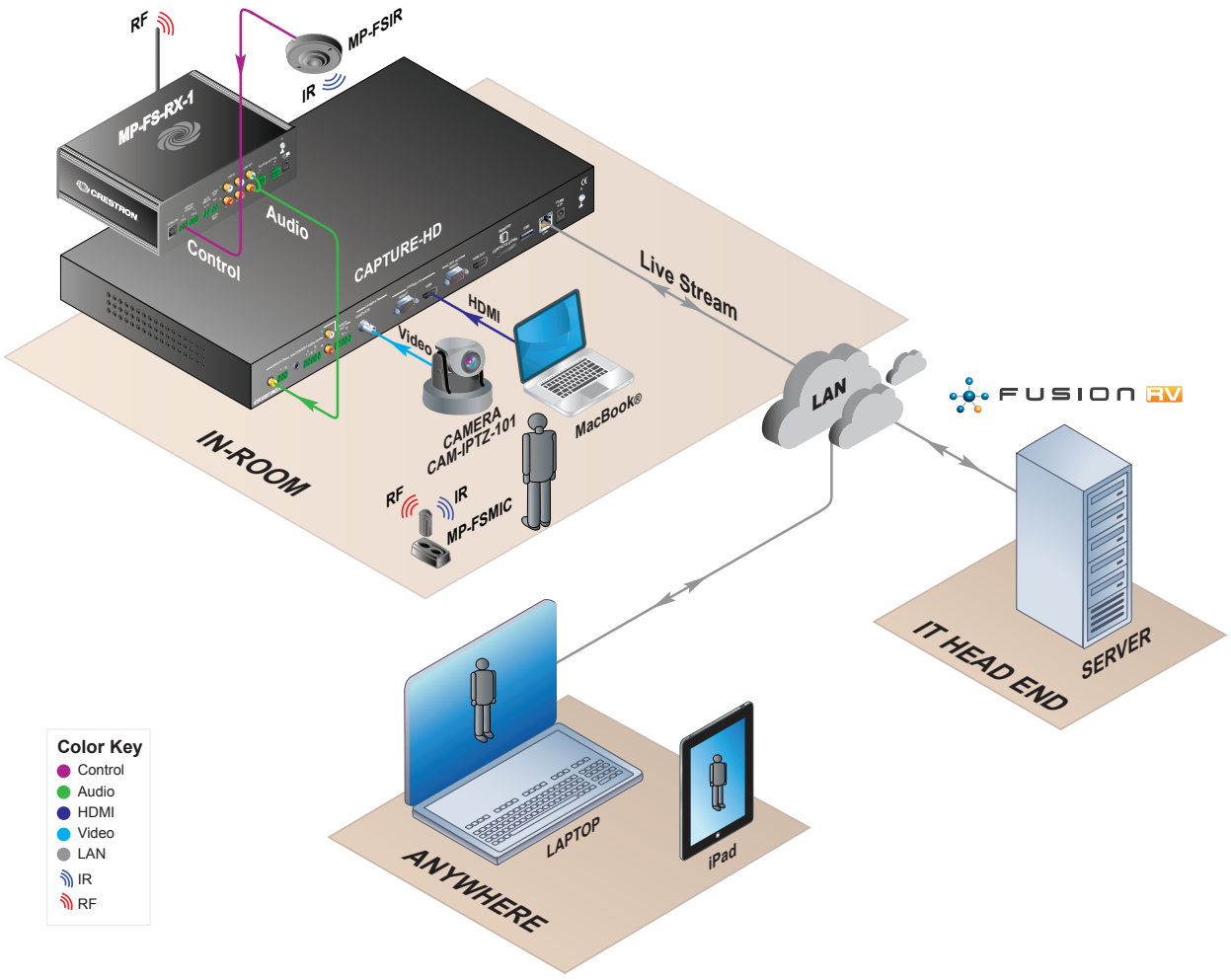
| Component | Task | Location |
|---|---|---|
| Capture recorder | Record and Upload | In the room where capture is taking place |
| Fusion RV with Media Services server | Approve, Transform, Publish, and Distribute | Server Room and Head End |
| Computer or mobile device | View | Comfort from a home, library, office, etc. |

The in-room hardware does the actual capture, the behind-the-scenes servers transcode the publish recorded material, and the playback occurs via a stream or simple file download. Each piece of the CaptureLiveHD system can be customized to the application.

*CaptureLiveHD Process*



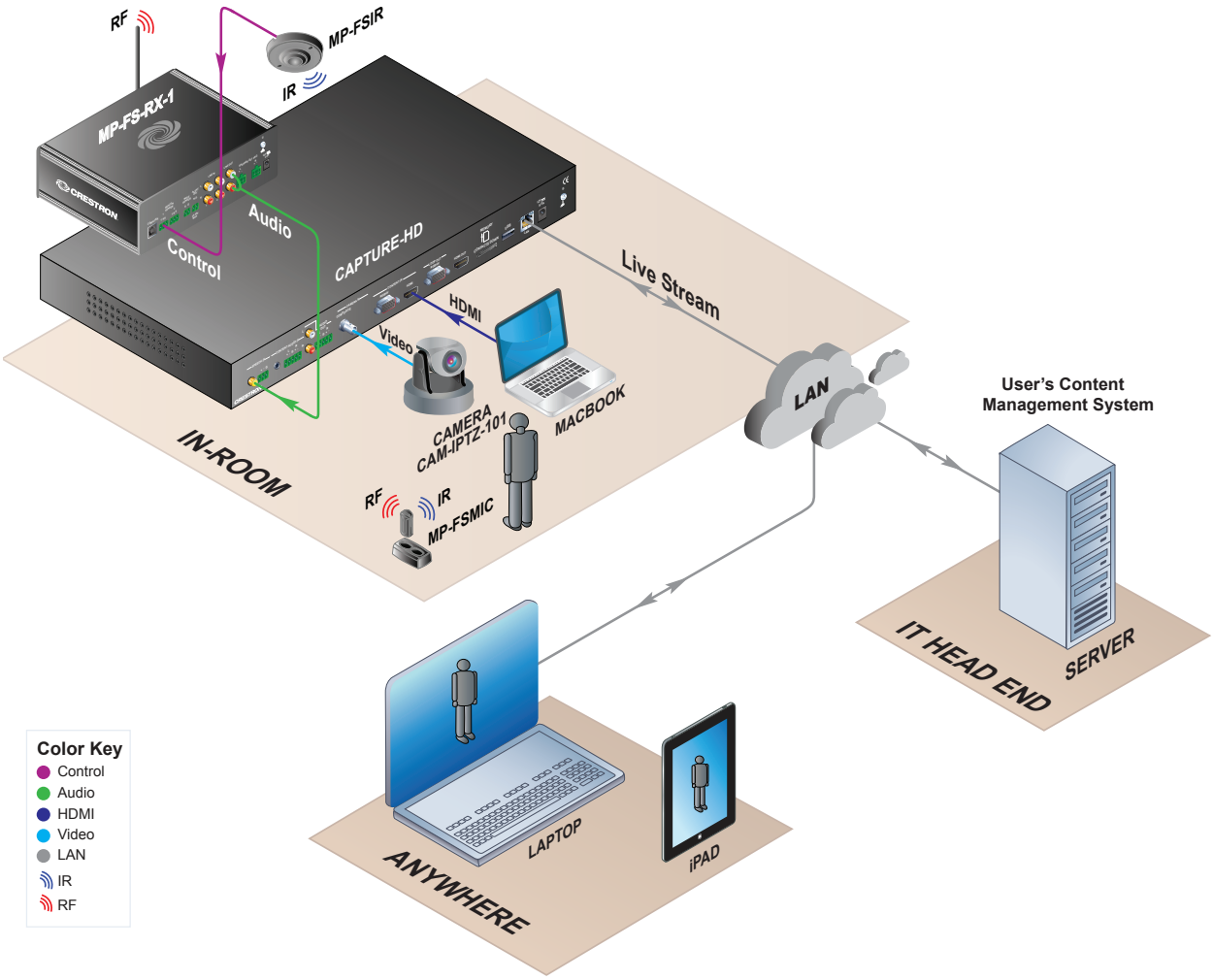
*CaptureLiveHD Complete System Application*




The illustration above shows the entire overview of a CaptureLiveHD system as follows:

- A meeting or class is scheduled via Fusion RV, Outlook®, Notes®, or R25®.
- The CAPTURE-HD, FreeSpeech microphone, and camera all exist in the room where the capture is taking place. The presentation is recorded to the CAPTURE-HD's memory (MMC or removable mass storage).

### *CAPTURE-HD as Part of a Streaming Solution*




The illustration above shows how the CAPTURE-HD may be used with a Content Management System (CMS). In this configuration, the CAPTURE-HD provides live content, which can be recorded, edited, and processed:

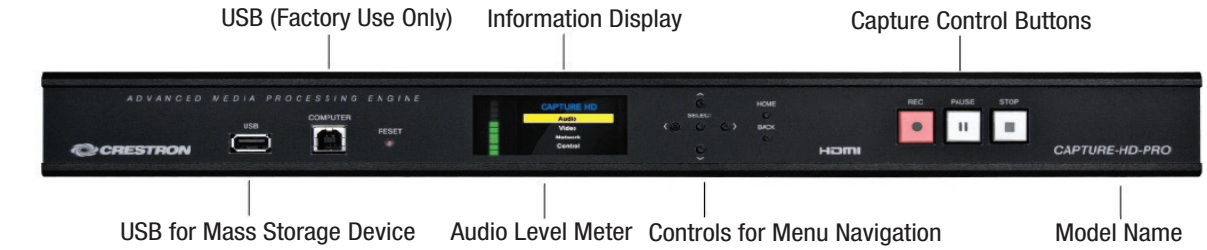
- The control system is used to start, monitor, and stop the stream from the CAPTURE-HD.
- The CAPTURE-HD, FreeSpeech microphone, camera, and content all exist in the room where the capture is taking place. The presentation is streamed from the CAPTURE-HD to the content management system.
- The content management system may be used to record, rebroadcast, and distribute the content.

# In-Room Hardware Requirements

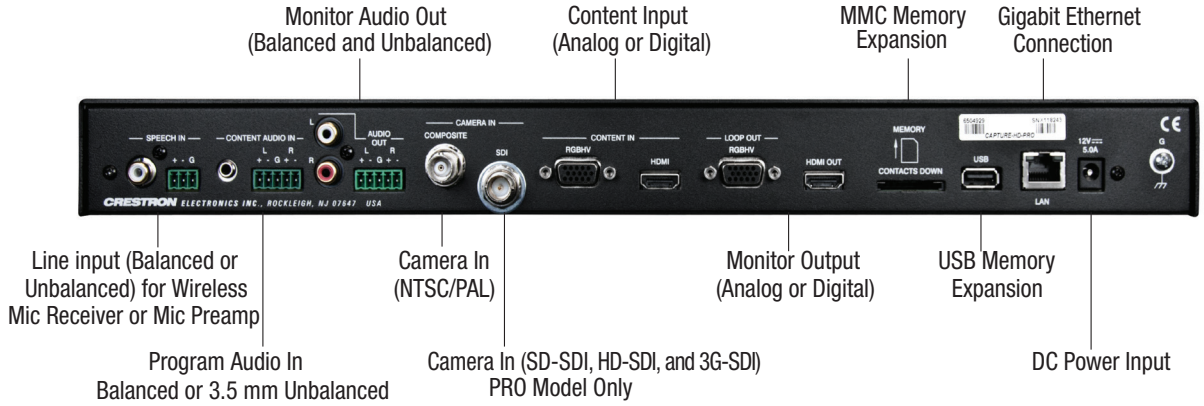
## CAPTURE-HD Options

Every CaptureLiveHD system depends on one core device: CAPTURE-HD or CAPTURE-HD-PRO. These models are the video recorders that capture and push the newly created content to the Fusion RV Media Services server where it is then transcoded and distributed.

### *CAPTURE-HD-PRO Front Panel*

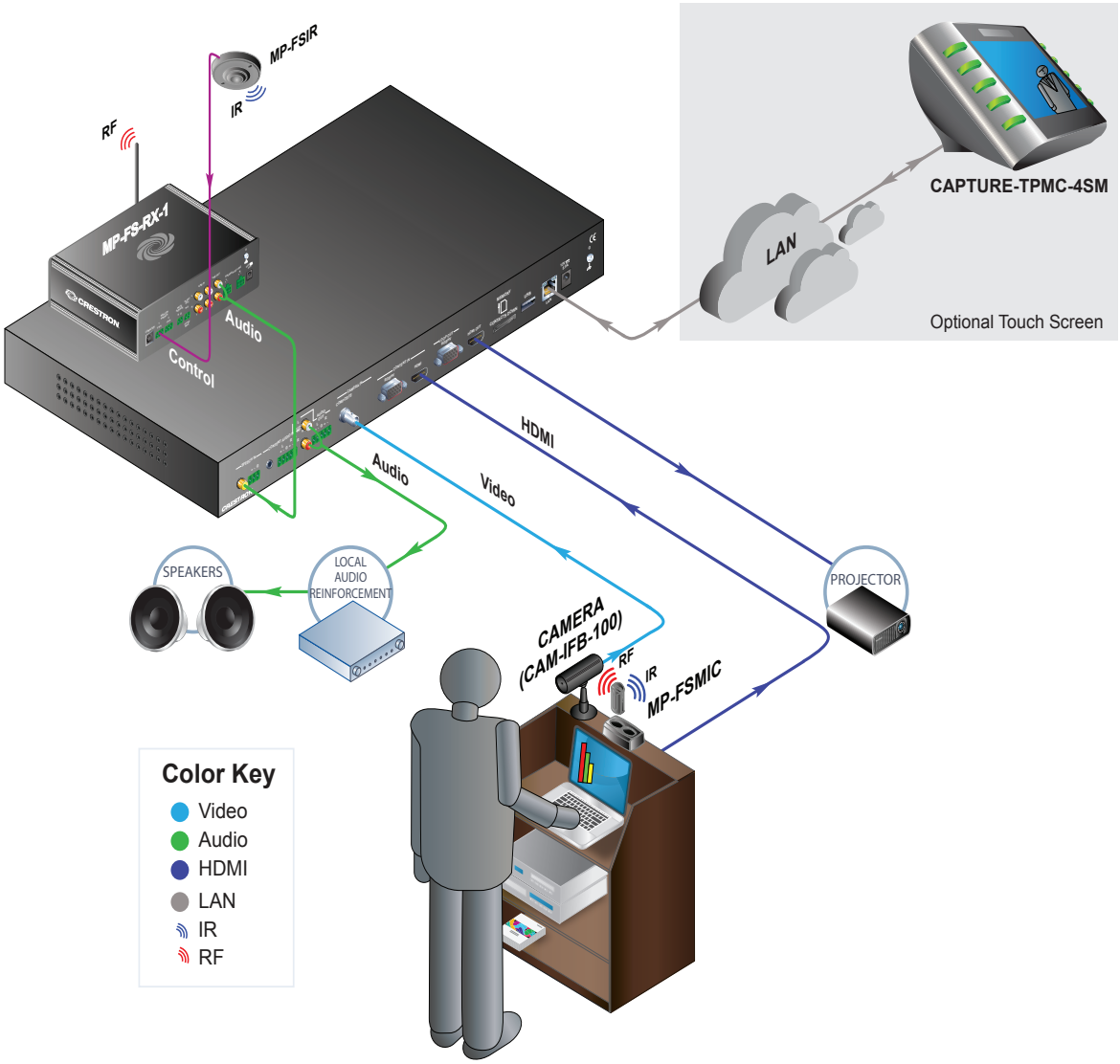



### *CAPTURE-HD-PRO Back Panel*


Monitor Audio Out (Balanced and Unbalanced)
Content Input (Analog or Digital)
MMC Memory Expansion
Gigabit Ethernet Connection
Line input (Balanced or Unbalanced) for Wireless Mic Receiver or Mic Preamp
Program Audio In Balanced or 3.5 mm Unbalanced
Camera In (NTSC/PAL)
Camera In (SD-SDI, HD-SDI, and 3G-SDI) PRO Model Only
Monitor Output (Analog or Digital)
USB Memory Expansion
DC Power Input

NOTE: A 3G, HD, SD-SDI camera input and composite input was added to the CAPTURE-HD-PRO model.

*Basic In-Room Configuration of CaptureLiveHD*




The following products are show in the illustration above:

- **Laptop**: The laptop is the content source—slides, web pages, etc. are captured and passed through the HDMI output onto the projector.
- **Camera**: The wide-angle camera (CAM-IFB-100) is mounted on the podium to record the presenter. The CAM-IFB-100 is a good choice when the wiring needs to stay contained at the presenter location. Use CAM-IPTZ-101 for installation in the rear of a room or in scenarios with multiple presenter locations.
- **Microphone**: A FreeSpeech microphone is used to record the presenter's speech. Program audio from the laptop is recorded; it is also passed throughout the audio output to the local in-room audio reinforcement system.
- **Touch Screen Controller:** The optional CAPTURE-TPMC-4SM provides convenient user control of the CAPTURE-HD and camera preview. This only connects to the network and communicates directly with the CAPTURE-HD (no control system required).

## Touch Screen Convenience

For added convenience and easier user control, Crestron offers a touch screen that pairs with the CAPTURE-HD and the CAPTURE-TPMC-4SM. This touch screen provides direct control of the CAPTURE-HD recorder without any programming or control system. The CAPTURE-TPMC-4SM, in conjunction with one of the Crestron cameras (CAM-IBF-100, CAM-IPTZ-100, and CAM-IPTZ-101), provides a camera preview window.

CAPTURE-TPMC-4SM provides a GUI (graphical user interface) to access the following features:

- Operational Mode (Record or Stream)
- Start, pause, and stop
- Bookmarks
- Camera preview window
- Audio level adjustments
- Source selection
- Screen layout and arrangement
- Memory storage device selection
- FTP settings
- Network camera settings
- Recording resolution and bitrate settings

NOTE: The CAPTURE-HD records camera video via the composite or SDI input, not via streaming MJPEG video. The MJPEG video stream is only used for preview on the CAPTURE-TPMC-4SM touch screen. The Crestron CAM-IFB-100 and CAM-IPTZ-101 cameras can output both composite and MJPEG streams simultaneously. If using a third-party camera, be sure to check its video output capabilities if touch screen preview is desired.

For more detailed information, refer to CAPTURE-TPMC-4SM on the Crestron website.

## Cameras

Crestron offers several different camera models in the CaptureLiveHD family. These cameras are recommended because of their complete integration with the system; although, they are not required. Any composite or SDI camera is acceptable (SDI is only available through CAPTURE-HD-PRO). The Crestron camera models are shown in the table below.

| Features | CAM-IFB-100 | CAM-IPTZ-100 | CAM-IPTZ-101 |
|---|---|---|---|
| Video Output | Composite | Composite | Composite |
| Streaming Output | MJPEG | MJPEG | MJPEG |
| Pan-tilt-zoom | - | Yes | Yes |
| Built-in web-based setup | Yes | Yes | Yes |
| Optical Zoom | Fixed | 26x | Optical 2.4X (digital 4X) |
| Optimal Placement Distance | 3-5 ft (1-2 mm) from subject | 10-30 ft (3-10 mm) from subject | 5-20 ft (2-6 mm) from subject |

Refer to the table below when choosing a third-party camera.

| Feature | Considerations |
|---|---|
| Composite, SDI, or HDMI output | Composite cameras are lower-cost<br>SDI cameras enable HD recording of the presenter (better image quality if the recording presenter is in full-screen)<br>HDMI cameras require an HDMI to SDI converter<br>Third-party choices: AJA® HA5, Blackmagicdesign Mini Converter HDMI to SDI, and Matrox® Convert DVI™ |
| Ethernet streaming output | Simultaneous MJPEG streaming output with composite/SDI output enables camera preview on a CAPTURE-TPMC-4SM touch screen |
| Pan-Tilt-Zoom | Option for the presenter to move around the room while being recorded<br>Option to zoom in or out<br>Some cameras offer face tracking which automatically follows the subject<br>Refer to the Crestron website for Integrated Pan/Tilt camera models. |
| Fixed or zoom lens | When creating standardized systems, the camera mounting location may vary from room to room |

**Tips:**

- One of the most important parts of capturing video is lighting. Consider installing a light specifically for presentation capture and setting a lighting scene that illuminates the presenter.
- Some PTZ cameras have face detection technology that can automatically track a presenter when the presenter is moving around the room.

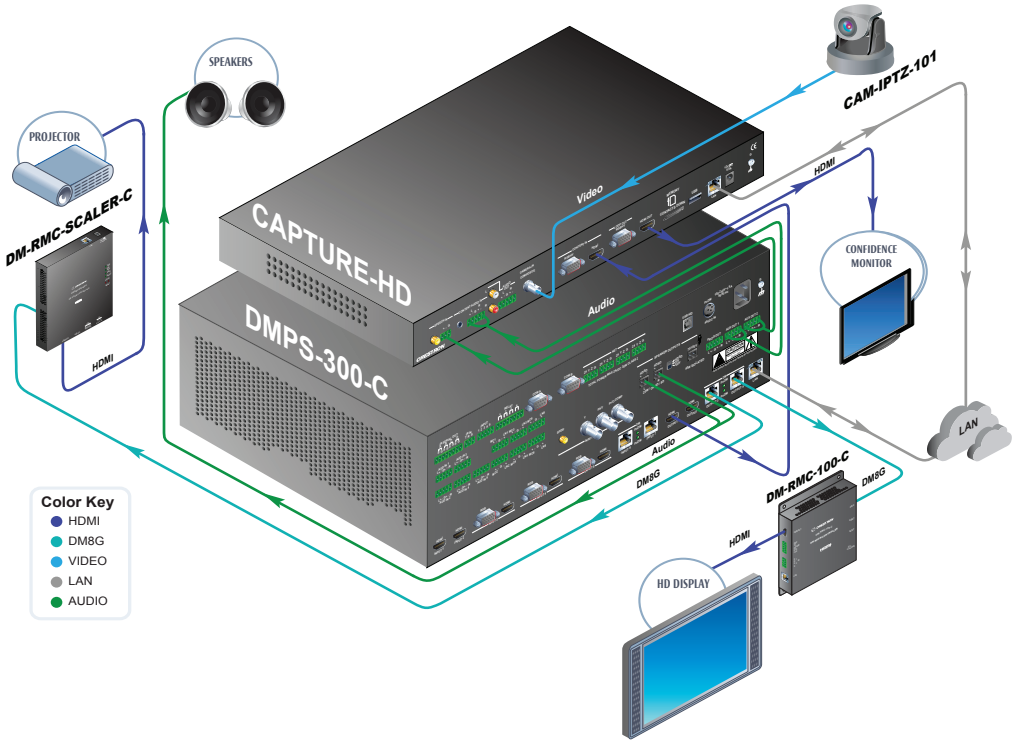
## Microphones

Crestron offers the FreeSpeech line of wireless microphone products in the CaptureLiveHD family. The FreeSpeech system is affordable and easy to use. The microphone hangs around the user's neck via a lanyard; therefore, there is no need for a belt pack or wires.

Refer to the information below when choosing a wired or wireless third-party microphone.

- A wired microphone requires a mic preamplifier to bring the signal up to the proper level for use with the CAPTURE-HD. If the presenter is standing at a podium, then a wired microphone should be considered.
- A wireless microphone receiver typically outputs line-level audio and is capable of being input directly into the CAPTURE-HD. If the presenter is moving around the room, then a wireless microphone should be considered.

*CAPTURE-HD with DMPS-300-C System*




The illustration above shows the following configuration:

- Any AV source connected to the DMPS-300-C can be captured by the CAPTURE-HD.
- The CAM-IPTZ-101 is located in the rear of the room.
- The display monitors the source being input into the CAPTURE-HD.
- Any source can be routed to the projector independent from the captured source.

## Integrating CAPTURE-HD with Control Systems

The CaptureLiveHD system can be integrated into a Crestron control system. All functionality available on the front panel and CAPTURE-TPMC-4SM is available in SIMPL Windows, which allows the programmer to create a customized solution.

Integrating CAPTURE-HD into a Crestron control system provides the following capabilities:

- A single touch screen, keypad, remote, or web or mobile interface controls the AV functions and CAPTURE-HD in both rooms
- Expanded control via a touch screen
- Ability to easily route video and audio sources into the CAPTURE-HD via a switcher

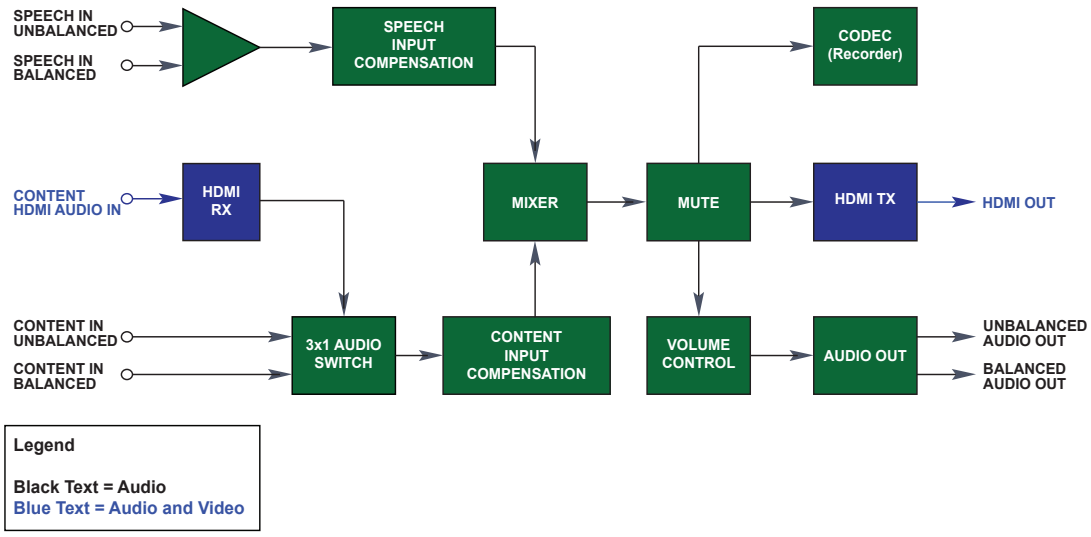
Integration with a complete AV presentation system may offer the following benefits:

- Feed in-room voice-lift systems (via an aux output) into the CAPTURE-HD
- Send a mix that includes multiple microphone signals (presenter and room)
- Start and stop streams for recording and distribution

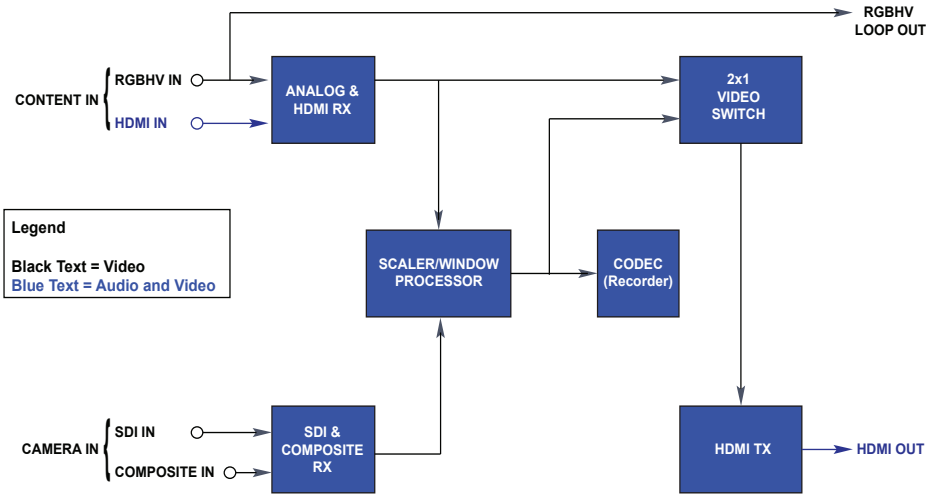
# Nuts and Bolts of CAPTURE-HD

## CAPTURE-HD Block Diagrams

### *CAPTURE-HD Audio Block*




### *CAPTURE-HD Video Block*




NOTE: The CAPTURE-HD recording capability is disabled when streaming.

## File Type

The CAPTURE-HD records audio and video in an MPEG transport stream (.ts extension) or MPEG-4 Part 14 (commonly referred to as MP4, .mp4 extension) container file. MPEG-TS files are accessible and can withstand corruption even if a drive is removed or power fails while recording is underway. The MPEG-TS format uses an MPEG-2 container, but the video CODEC used inside the container is H.264 (also known as MPEG-4 AVC) and the audio CODEC in the container is AAC (MPEG-4 audio).

## Recording Bitrate

The file can be recorded in bitrates from 2 Mbps to 6 Mbps. The specified bitrate is the maximum value at which the file is encoded. If there is minimal motion in the video, for example when displaying a PowerPoint® image, the average encoding rate is lower. The video recording bitrate versus the card capacity is shown in the table below.

| Video Recording Bitrate[1] | Space Required (Per Hour) | Video Capacity 16 GB Card | Video Capacity 32 GB Card |
|---|---|---|---|
| 500 Kbps | 225 MB | 66 hours | 133 hours |
| 1 Mbps | 450 MB | 33 hours | 67 hours |
| 2 Mbps | 900 MB | 18 hours | 36 hours |
| 3 Mbps | 1.4 GB | 12 hours | 24 hours |
| 4 Mbps | 1.8 GB | 9 hours | 16 hours |
| 5 Mbps | 2.3 GB | 7 hours | 14 hours |
| 6 Mbps | 2.76 GB | 6 hours | 12 hours |

[1]Either 720p or 1080p can be recorded at these rates.

NOTES:

- The CAPTURE-HD can be configured to automatically upload the recordings via FTP immediately after a capture so the internal memory is constantly being cleared out.
- The default file system is FAT32. Therefore, the maximum single file size is limited to 4GB.

## File Naming

The CAPTURE-HD can record to the internal MMC card slot **or** to a USB stick connected to either the front or rear USB ports (not both).

When the CAPTURE-HD records to the internal MMC slot, it can be configured to upload the captured file and an XML file with metadata to an FTP server when the recording is completed.

The files names follow the convention below:

<*HOSTNAME*>_<*DATE*>_TIME.TS (for example, ROOM101_2011-12-13_09_28_49.TS)

<*HOSTNAME*>_<*DATE*>_TIME.XML (for example, ROOM101_2011-12-13_09_28_49.XML)

NOTE: If using the MP4 file type, the captured file displays an .mp4 extension and not the .ts extension shown in the example above.

This ensures that the filenames are always unique for each recording and they can be sorted by the unit on which they were recorded and the time of recording. The XML file contains metadata associated with the file.

## File Playback

CAPTURE-HD saves files in the MPEG-TS container or the MP4 container. MP4 files have better compatibility and can be played back using most standard video players. MPEG-TS offers a robust container but may not be supported by most video players. For recommendations on playback methods, refer to the Crestron True Blue Online Help - Answer ID 5199. MP4 videos are becoming the standard for video on computers and mobile devices. They typically use the high-quality, low bitrate H.264 video codec with a high-quality AAC audio codec. MP4s are natively viewable in Windows® 7, Mac OS, iOS, and other operating systems. Other free cross-platform media players support older versions of Windows.

## Streaming Bitrate

The CAPTURE-HD can stream with bitrates from 500 Kbps to 6 Mbps. The specified bitrate is the average bitrate of the stream and supports streaming at 720p or 1080p. Scenes with minimal motion may have lower average bitrates because of compression.

## Streaming and Online Playback

The CaptureLiveHD system is designed so that the viewing experience is just as seamless as the recording. The best playback experience is achieved when using Fusion RV with Media Services server. Crestron recommends streaming the final content; however, the output file can also be downloaded.

There are two main ways to view content that has been recorded:

- View the stream using any Mac, PC, or mobile device (via Fusion RV with a Media Services server).
- Download the video file and view it on any device capable of playing back MP4 files.

## Server Requirements

The CaptureLiveHD system depends on a Fusion RV with Media Services server for it to be a complete solution with metadata, content transcoding, and distribution. Fusion RV provides a comprehensive way to manage AV resources, track usage, schedule maintenance, provide real-time help desk support, and schedule rooms from Microsoft® Outlook, Notes, R25 or a touch screen outside the room.

Media Services is a component of Fusion RV that enables integration with CAPTURE-HD. Fusion RV attaches metadata to scheduled recordings and transcodes and publishes them via an RSS feed.

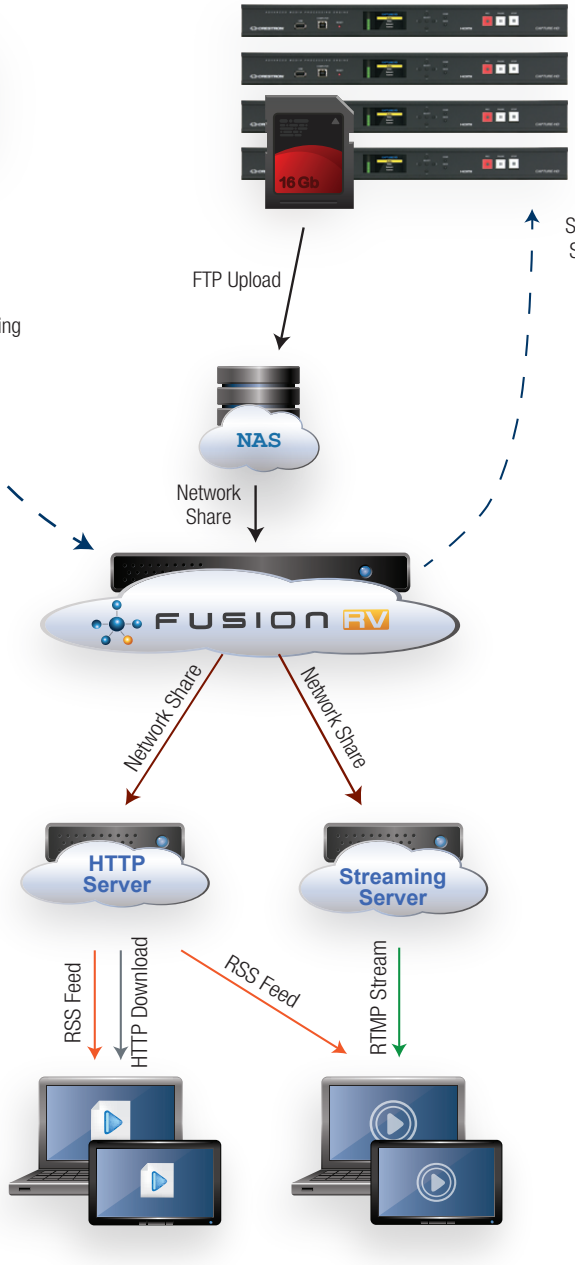
For more information on the Fusion RV workflow and viewing options, refer to the "CaptureLiveHD Workflow" section. For more information on Fusion RV, refer to the Crestron website.

**NOTE:** The CaptureLiveHD workflow video can be accessed on the Crestron website.

# CaptureLiveHD Workflow

The CaptureLiveHD system is designed so that a meeting or class can be recorded with minimum user intervention. This section describes the process of capturing a presentation—from scheduling to viewing content and all the intermediate actions that are processed by the Fusion RV with Media Services server.

*CaptureLiveHD Workflow*




### 1. Schedule

Schedule a session from Notes, R25, Microsoft Outlook, or the Fusion RV room scheduler. The schedule is sent to Fusion RV.

### 2. Synchronize Schedule

Fusion RV syncs the schedule information with the appropriate CAPTURE-HD.

### 3. Upload Recording

When recording is complete, CAPTURE-HD uploads the file to the NAS via FTP.

### 4. Process Video

Fusion RV looks at a watch folder on the NAS and prepares videos as they are available. This includes transcoding them into the various formats required for download and streaming.

### 5. Publish Content

After the videos are transcoded, they are pushed to the HTTP server and, if desired, the streaming server. The HTTP server hosts the downloadable MP4s and the RSS feeds (RSS feeds required for download and streaming).

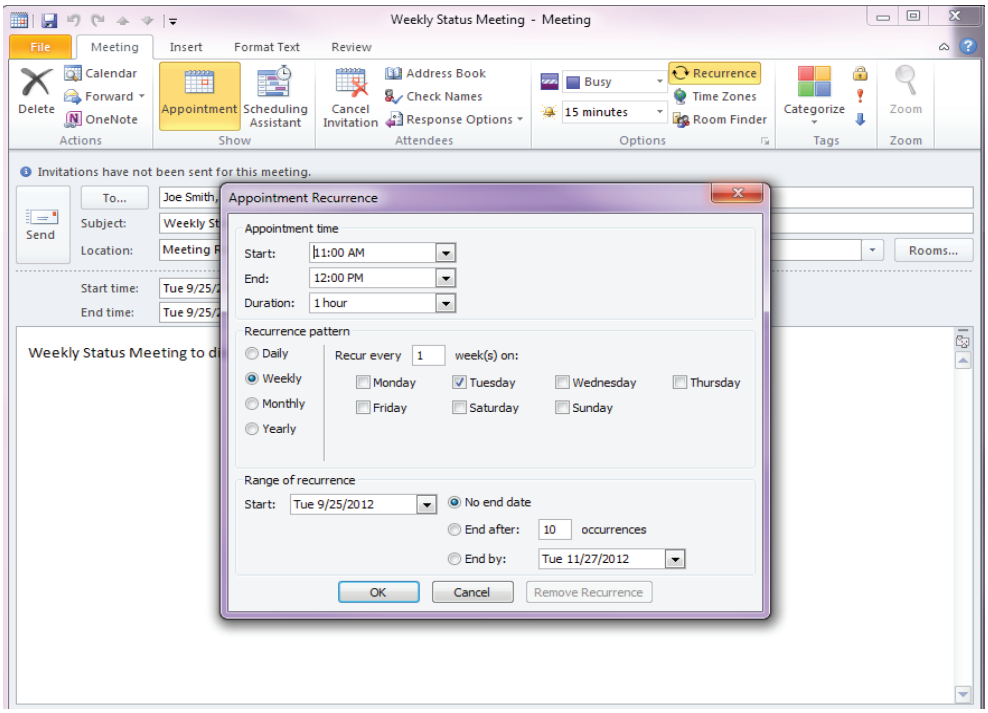
### 6. View Content

Once the videos are published, they can be viewed on an array of devices.

## Scheduling

The first step in creating a recording is to schedule the event (meeting, class, etc.). This can be done using the enterprise scheduler software (Notes, R25, or Microsoft Outlook) or in the scheduler built into Fusion RV. The meeting should be booked as usual, and the room where the CAPTURE-HD is located should be assigned to the meeting.

### *Scheduling a Meeting with Outlook*




When a meeting is scheduled, Fusion RV provides the meeting details automatically to the Capture HD recorder, including the subject and the organizer. Fusion also provides a Capture Profile to the device, which is a set of rules that dictate how the recording is published and distributed after the recording.

The Capture Profile is attached to the meeting because separate meetings may have different requirements for distribution. For example, a university may set different profiles for the business and engineering schools even though they use the same scheduler and Fusion RV installation. The same CAPTURE-HD (in the same room) can publish to many different locations based on the meeting requirements. The Capture Profile is assigned by editing the meeting from the Fusion RV scheduler. One of the profiles is set as the default, so it is used if a meeting is booked and no one alters the profile.

## Recording

When the schedule is downloaded by the CAPTURE-HD, the scheduled meeting information is displayed on the front panel and is available to the Crestron control system or touch screen in the room so that the presenter can see what they are about to record. The presenter then has the option to record the meeting with the scheduled metadata.

If there is nothing scheduled or if the schedule is incorrect, they can record their meeting without the metadata, called an ad-hoc or guest recording. For more information on the differences between the two recording options, refer to the "Publishing" section.

***CAPTURE-TPMC-4SM Meeting Selection Page***

It is important to note that by default, the CAPTURE-HD does not begin recording based on the scheduled meeting; it waits for the user to press the record button. By doing this, the need to trim a video is minimized.

Alternatively, a Crestron control system can automatically start recording based on an action. For example, it could start recording as soon as the presenter turns on the projector or selects a source.

### Bookmarks

The presenter can add bookmarks at any time during a presentation by pressing the **Add Bookmark** button on the touch screen. The Add Bookmark feature is only available when using the touch screen or a Crestron control system. This feature adds a keyframe screenshot and time stamp, which is accessible during viewing via the Crestron Media Player. The bookmarks feature requires a fully integrated CaptureLIveHD system using Fusion RV software. Playback of bookmarked recordings is exclusively supported using the Crestron Media Player.

***CAPTURE-TPMC-4SM Recording Screen and Web Streaming with Bookmarks***

## Stopping

In addition, the CAPTURE-HD stops recording only when the stop button is pressed. Since meetings differ in how long they last, the manual control allows the presenter to determine just what should or should not be recorded.

## Uploading

When the stop button is pressed, the CAPTURE-HD automatically begins uploading the recording and its associated metadata via FTP. In a typical deployment, all CAPTURE-HD devices are set to upload to the same location so that all of the content is located in one spot. The CAPTURE-HD does not upload and record simultaneously, so if another recording begins, the FTP transfer is paused while the new recording occurs. When the new recording is stopped, all file transfers resume.

FTP transfers take about 20% to 50% of the initial recording time, depending on the bitrate of the recording and the speed of the network (Crestron recommends Gigabit connectivity to the CAPTURE-HD). The CAPTURE-HD FTP transfer speed is usually about 10 Mbps, so if 25 Capture devices are uploading simultaneously (for a total of 250 Mbps), a typical well-designed network and file server can handle the traffic. The advantage to using FTP to upload after the event, instead of streaming during the event, is that any network interruptions or slowdowns are handled effectively.

NOTE: In large deployments where there may be concern about overloading the FTP server, set different groups of CAPTURE-HD boxes to upload to different FTP servers.

When the CAPTURE-HD has completed the upload, and the file's contents are verified on the server, the file is removed from its local MMC or USB memory to make room for new recordings.

## Publishing

Fusion RV watches the folder(s) where the Capture HD devices are uploading the recordings. When a new recording appears in the folder, Fusion RV reads the metadata to determine what should be done with the recording.

### Metadata

If a scheduled meeting is recorded, the file is converted to the desired formats (transcoded) and then published (the RSS feed is posted and updated and the videos are posted to the streaming server or as downloadable MP4s) as soon as possible.

If the recording was completed without metadata (for example, if there was no scheduled meeting or if the presenter determined that the meeting information was incorrect), Fusion RV pauses and marks the item as "Action Required" with basic metadata such as the room name and time of recording.

An e-mail can be sent to the person responsible for the recordings (for example, technology manager, owner of the room, etc.). The e-mail notification is configurable. This person can access the Fusion RV interface, view the recording, and then add the appropriate metadata. The publishing process continues as if the user had recorded a scheduled meeting.

### File Conversion

Fusion RV publishes the recordings following the steps shown below.

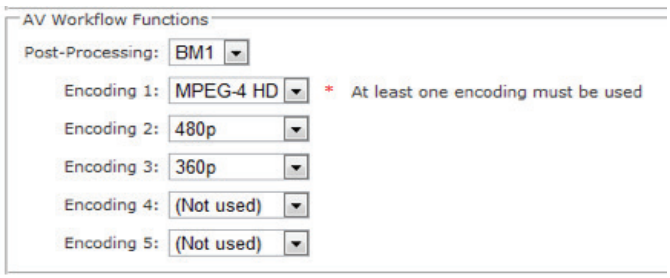
#### 1. Transcoding

Fusion RV takes the uploaded file received from the CAPTURE-HD and transcodes it into one or more resolutions for publishing. The ability to encode into multiple resolutions is provided because the Crestron Media Player supports dynamic bitrate video (DBV). This allows the Crestron Media Player to pick the best resolution video based on the Internet connection speed. Up to 720p or 1080p video can be served up to the people who can view it, but slower connections may need to view 480p video. Up to five video resolutions can be selected for each distribution channel. Publishing in more formats takes longer but provides more accessibility to the users. For more information, refer to the "Publishing Speeds" section.

By default, 360p, 480p, and 720p MP4 files are created from the original .ts file. Depending on the Internet connection speeds (whether located on campus or an internal network, on a high-speed Internet connection, or on a slower connection like DSL), the user may only be able to achieve sustained network speeds of 300 to 500 Kbps instead of the 1 Mbps typically used in high-definition feeds.

NOTE: Video render formats can be selected during setup.

***Selecting Video Render Formats***


AV Workflow Functions
Post-Processing: BM1
Encoding 1: MPEG-4 HD * At least one encoding must be used
Encoding 2: 480p
Encoding 3: 360p
Encoding 4: (Not used)
Encoding 5: (Not used)

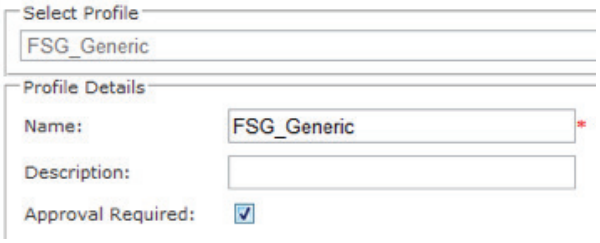
## 2. Uploading

After Fusion RV finishes transcoding the video into various formats, the videos are moved to the appropriate servers. This is accomplished using Windows file sharing (also known as UNC).

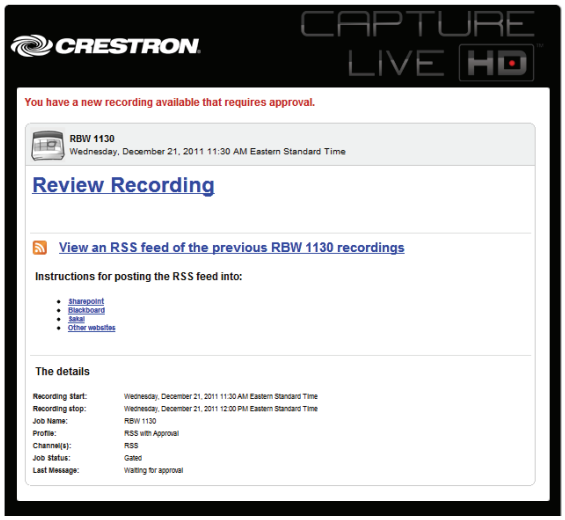
## 3. Approval (Optional)

If the Fusion RV profile is configured to require approval before publishing, Fusion RV sends an e-mail to the meeting organizer to get an approval before links to the video are published.

*Profile Configuration Window (Enable or Disable Approval)*




*Approval E-mail Window*


CRESTRON
CAPTURE LIVE HD
You have a new recording available that requires approval.
RBW 1130
Wednesday, December 21, 2011 11:30 AM Eastern Standard Time
Review Recording
View an RSS feed of the previous RBW 1130 recordings
Instructions for posting the RSS feed into:
Sharepoint
Blackboard
Sakai
Other websites
The details
Recording start: Wednesday, December 21, 2011 11:30 AM Eastern Standard Time
Recording stop: Wednesday, December 21, 2011 12:00 PM Eastern Standard Time
Job Name: RBW 1130
Profile: RSS with Approval
Channel(s): RSS
Job Status: Gated
Last Message: Waiting for approval

## 4. Publishing

Once the video is uploaded and approved (if required), Fusion RV updates the RSS feed for the video and sends out e-mail notifications with links to the video.

## Publishing Speeds

File publishing speeds vary depending on the server hardware that is used. The Crestron benchmark server consists of the following:

- Dual Intel® Xeon® X5650 CPUs
- 8GB RAM
- Windows Server® 2008 R2
- 7200 RPM SATA HDD

If the file is published using the defaults, which is considered the best delivery method, each 1 hour video file takes approximately 15 minutes of CPU time to transcode, making it capable of transcoding four times real time. This delivery method creates video files at 720p, 480p, and 360p so that the Crestron Media Player can select the appropriate video format depending on the client's connection speed.

NOTE: Each video takes longer than 15 minutes if done one-by-one, but the server is configured so that multiple jobs are processed in parallel.

Refer to the table below for information on how often the Capture HD devices are used and how many devices can be supported by a single server.

| **Daily Capture Usage (Recording Hours Per Room)** | **Number of CAPTURE-HD Units Supported by a Single Server** | | |
|---|---|---|---|
| | **Dynamic Bitrate Video** | **720p** | **480p** |
| 2 hours | 40 | 80 | 120 |
| 4 hours | 20 | 40 | 60 |
| 8 hours | 10 | 20 | 30 |

NOTE: Fusion RV can be installed on multiple servers to increase the overall processing power with no additional Fusion RV software cost.

## Streaming Video with Wowza

To provide web pages over the Internet, web servers such as Apache™use the HTTP protocol. Unfortunately, that protocol does not stream video, so separate server software must be used. Several competing standards for streaming video have emerged from the major web video competitors as shown in the table below.

| Company | Streaming Technology |
|---|---|
| Adobe® | Flash® (RTMP) |
| Apple® | HTTP Live Streaming |
| Microsoft | Silverlight® Smooth Streaming |

Wowza® is the only server technology that supports all of the major streaming formats on a single piece of software; therefore, Crestron has chosen it as the preferred streaming server technology for the CaptureLiveHD application. The RTMP streaming capabilities of Wowza are utilized to stream the content to the Crestron Media Player.

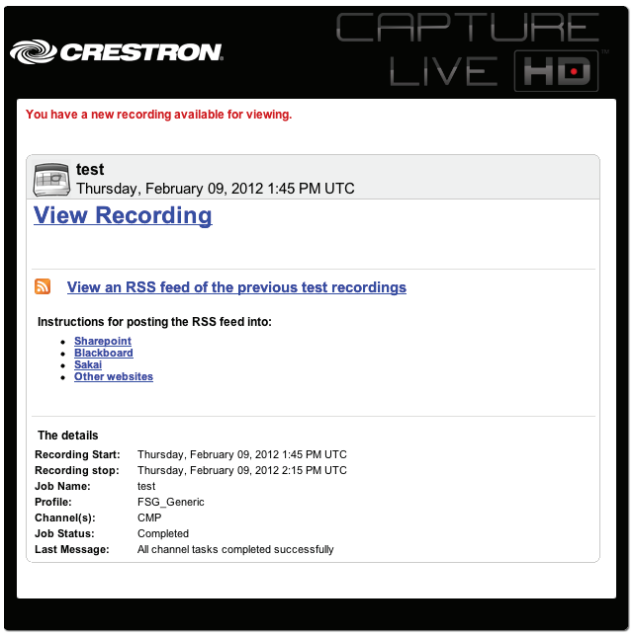
When video transcoding is complete, Fusion RV copies the recordings to a directory accessible by the Wowza server for streaming. From there, Wowza is able to stream the videos without Fusion RV intervention.

Wowza can also be configured to receive and rebroadcast streams received from the CAPTURE-HD. Streaming is enabled through programming in SIMPL Windows. For Wowza configuration instructions and details about the parameters and options available in SIMPL Windows, refer to the Crestron website and SIMPL Windows help.

## Posting the Content for Viewing

The first time that a meeting occurs, Fusion RV creates a single-item RSS feed with a link to that video and sends an e-mail notification that it was posted.

### *E-mail Notification Example*

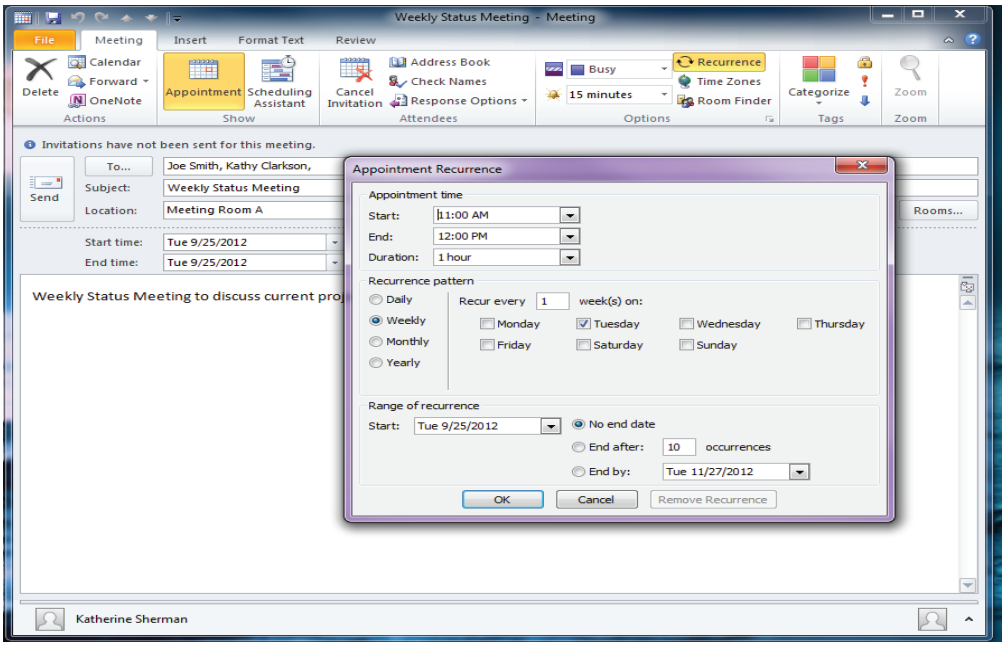

CRESTRON
CAPTURE LIVE HD
You have a new recording available for viewing.
test
Thursday, February 09, 2012 1:45 PM UTC
View Recording
View an RSS feed of the previous test recordings
Instructions for posting the RSS feed into:
Sharepoint
Blackboard
Sakai
Other websites
The details
Recording Start: Thursday, February 09, 2012 1:45 PM UTC
Recording stop: Thursday, February 09, 2012 2:15 PM UTC
Job Name: test
Profile: FSG_Generic
Channel(s): CMP
Job Status: Completed
Last Message: All channel tasks completed successfully

If the meeting is recurring, each time a new occurrence of the meeting is recorded, a new link is added to the RSS feed and the e-mail notification can be sent regarding the update. This list is e-mailed to the organizer of the meeting and any other users configured to receive the notification as soon as the meeting is ready to be published. The list is created in the RSS 2.0 format so that it can easily be embedded into any web page.

The RSS feed works as follows:

1. The data in the RSS feed is derived from the scheduling information.

   *Appointment Recurrence Window in Outlook*




2. The Fusion RV server generates a new RSS feed for this recurring meeting.

   **Weekly Status Update**

   Monday, October 14, 2014 9:30 AM - 10:00 AM UTC

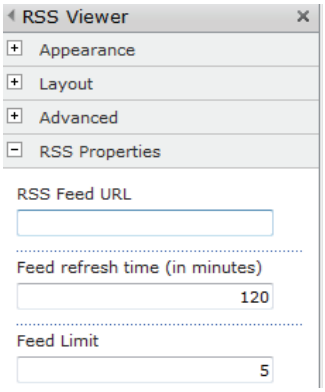
3. As the meetings occur, new items are added to the RSS feed.

## Embedding the RSS Feed

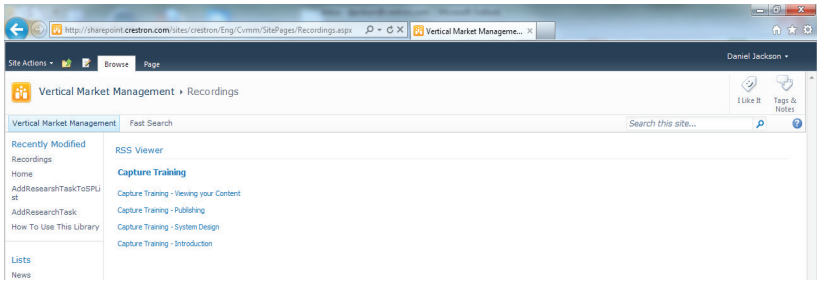
There are two methods to embed the RSS feed in the content management system such as Blackboard® or SharePoint®. Use the content management system's built-in RSS features, or use services such as Feed2JS to embed the RSS feed in any web page.

The examples below shows where the RSS feed information is entered in SharePoint and how it is displayed on the web page as a logged-in SharePoint user.

***RSS Feed Integration Window***




***RSS Feed Viewing Window***




NOTE: For each new meeting occurrence, the organizer receives an e-mail and the new occurrence is added to the RSS feed. This means the RSS feed needs to be embedded once and the list is updated automatically. There is an option to require the organizer (or designated other) to approve each recording before it is posted to the web. In this approval step, the organizer can also add notes to the recording.

## Publishing Locations

When Fusion RV publishes the content, the files are copied to two locations. Data files like the RSS feed, thumbnails, and configuration files for the Crestron Media Player are copied to one location and the recordings are copied to a second location.

When utilizing the Crestron Media Player, a web server such as Apache is needed to provide the data files to users via HTTP, while the Wowza streaming server is used to provide the recordings to users via RTMP and HTTP Live Streaming. For more information, refer to the "Scheduling" section.

***RSS Feed Viewing Window***

**Weekly Status Update**

Monday, October 14, 2014 9:30 AM - 10:00 AM UTC

Monday, October 21, 2014 9:30 AM - 10:00 AM UTC

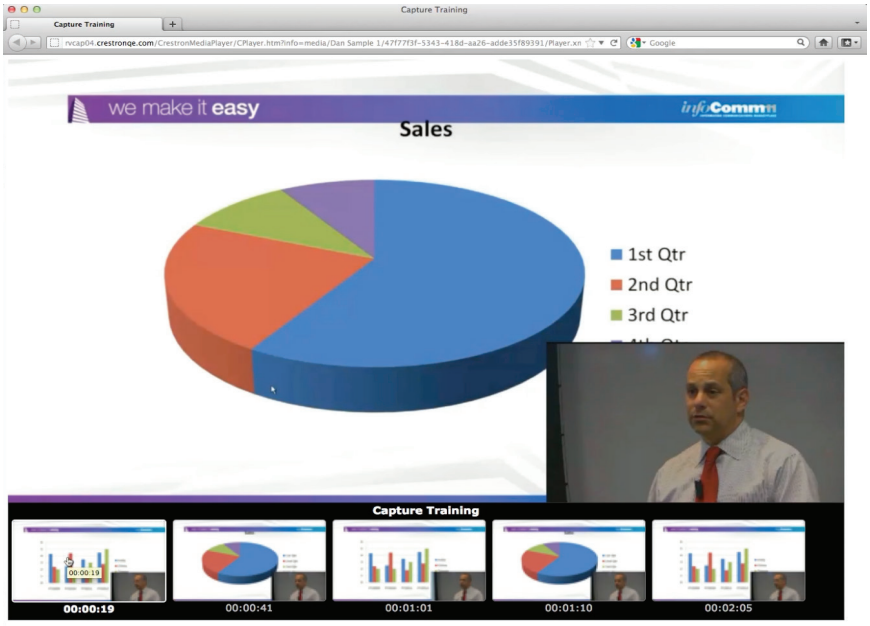
Monday, October 28, 2014 9:30 AM - 10:00 AM UTC

## Viewing

Fusion RV currently supports viewing the content via two methods: Crestron Media Player and Basic RSS Feeds with file download.

Crestron developed a web application to play back CaptureLiveHD content so that additional features beyond the typical web video can be provided. To support live streaming and other features, the Crestron Media Player channel requires that the Wowza streaming server software sends the recording to the user. For more information, refer to the "Streaming Video with Wowza" section.

*Viewing CaptureLiveHD Content*




The Crestron Media Player is written in Adobe Flash (HTML5 compatible player coming soon) and provides thumbnail navigation so that the user can access different bookmarks in the recording.

If using the Crestron Media Player web application to view the content, the original video can be transcoded into several levels and the player dynamically switches to the appropriate feed based on the video window size and connection speed of the user. The default transcoding formats are 720p and 480p, but 360p can be added as a lower-bandwidth option if there may be users on slow connections.

This is very similar to the way YouTube® and Vimeo™ provide various resolutions for the same video.

# Appendix A: CAPTURE-HD Screen Arrangements

The examples below show the possible ways the CAPTURE-HD source material can be arranged on the screen.

NOTE: These examples assume the presence of HD source content and a SD or HD camera feed. The black bars signify window space used by an HD camera fed into the HD-SDI connector.

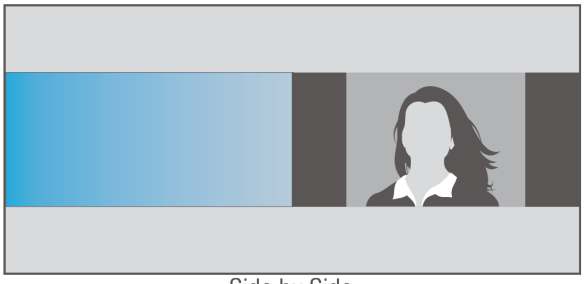
***CAPTURE-HD Screen Arrangements***

PIP - Lower Left

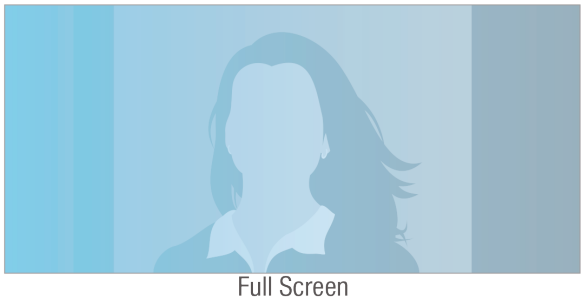
PIP - Upper Left

PIP - Lower Right

PIP - Upper Right



Side by Side



Full Screen
(only one video source appears)

# Appendix B: CaptureLiveHD FAQs

1. *When using CAPTURE-HD in a stand-alone application, how do I set up preferences and add metadata to recordings?*

   The basic setup can be accomplished using the front panel. The recordings can be renamed and edited using third-party video editing and production software.

2. *When using CAPTURE-HD in a stand-alone application, can I access the CAPTURE-HD via the network?*

   The CAPTURE-HD can be controlled by an Ethernet-enabled Crestron processor or by the CAPTURE-TPMC-4SM.

3. *Is there a software application for configuration and control of CAPTURE-HD other than Fusion RV?*

   The basic setup and the record, pause, and stop functions can be accomplished using the front panel.

4. *Are there any sample videos that were created with CAPTURE-HD available for viewing or downloading?*

   Example videos created with CAPTURE-HD are currently not available but will be in the future.

5. *Is it possible to integrate CAPTURE-HD with Outlook using Roomview Express?*

   No, only Fusion RV has CAPTURE-HD control and integration capability.

6. *Is there a low cost software solution or Fusion RV license to support meeting and class scheduling and management?*

   Yes, Fusion RV may be used in Free mode for systems including five or less rooms or processors. There is no additional cost if already running RoomView Server Edition or Fusion RV.

7. *How does Fusion RV handle file archiving?*

   File archiving is not a feature of Fusion RV; however, the metadata provided by Fusion RV, which is included with the recorded file, provides everything needed to archive and organize video files into an existing library.

8. *How do I know if there is enough memory on the USB drive to record a 90 minute class?*

   The available storage space on the currently installed drive is displayed on the front panel menus and settings.

9. *What is the monthly or annual cost for using CAPTURE-HD? Are there any recurring charges?*

   There are no monthly or recurring fees or charges.

10. *How can the CAPTURE-HD be controlled if access to the front panel is not an option?*

    The CAPTURE-TPMC-4SM or a control system with UI or XPanel has direct control of CAPTURE-HD.

11. *Can the CAPTURE-HD send out any sort of live stream?*

    Yes, streaming is now available. Refer to the Crestron website for more information.

12. *Is the back end delivery protocol a progressive download or a true stream?*

    The CAPTURE-HD supports both FTP, which is progressive, and live streaming.

13. *The descriptions for the camera models CAM-IFB-100, CAM-IPTZ-100 and CAM-IPTZ-101 include HD streaming. How is streaming video being used in a CAPTURE-HD system?*

    The camera's composite video output is recorded along with the HDMI input of the CAPTURE-HD. The streaming feature is used to allow the presenter to view a live recording on the Crestron touch screen.

14. *What is the largest file size that can be recorded?*

    CAPTURE-HD uses FAT32, which has a maximum file size of 4 GB.

15. *Are there other limitations to the size of the recording?*

    A .ts file has no size limitation but MP4 has a maximum file size of 4 GB which is independent of the file system being used.

16. *What happens when the server is unavailable?*

    The system uses a round robin approach for uploading recorded files. If an upload fails, the system retries after going through all other pending uploads. The Max_Upload_Retries join is now obsolete because of this change.

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Refer to the listing of Crestron worldwide offices on the Crestron website www.crestron.com/offices for assistance within a particular geographic region.

Printed in USA Doc. 4552F 3/2015